

CLAIMS

What is claimed is:

1. A cable tie for bundling elongate articles, said cable tie comprising:
an elongate strap having opposing free and base ends, said strap further having a longitudinal central axis and being deformable into a loop such that said central axis is contained in a central plane,

said strap having a primary grip surface and a transverse strap tooth which extends therefrom, said strap tooth having a transverse cross-section bounded by an outer periphery having a planar portion which is perpendicular to said adjoining portion of said primary grip surface, said outer periphery of said strap tooth further having a convex portion; and

a head having a base extending from said base end of said strap such that said planar portion of said strap tooth faces said head, said head having a passageway with opposed entry and exit ends such that said free end of said strap can be inserted into said passageway through said entry end and exit said passageway through said exit end, said passageway having a longitudinal central axis which is contained in said central plane,

said head having a pawl which is flexibly connected to an inner surface of said base such that said pawl is adjacent to said passageway, said pawl being biased to an initial locking position and movable therefrom to an insertion position,

said pawl having a grip surface and a pawl tooth which extends therefrom such that said pawl tooth extends into said passageway when said pawl is in said initial locking position, said pawl being removed from said passageway when said pawl is in said insertion position,

said pawl tooth having a transverse cross-section bounded by an outer periphery having a planar portion which is perpendicular to said central axis of said passageway when said pawl is in said initial locking position, said outer periphery of said pawl tooth further having a convex portion, said pawl tooth being oriented relative to said passageway such that said planar portion of said pawl tooth faces said exit end when said pawl is in said initial locking position,

said pawl being oriented relative to said passageway such that, when said strap is sufficiently inserted therein through said entry end, said convex portion of said strap tooth engages said convex portion of said pawl tooth, sufficient further insertion of said strap into said passageway causing movement of said pawl to said insertion position wherein said planar portion of said strap tooth is longitudinally positioned between said planar portion of said pawl tooth and said exit end of said passageway such that said biasing returns said pawl to said initial locking position wherein said planar portions of said strap tooth and pawl tooth abut one another to obstruct retraction of said strap through said passageway in a direction toward said entry end.

2. A cable tie according to claim 1, wherein said periphery of said convex portion of said strap tooth has the shape of a quarter-circle.

3. A cable tie according to claim 1, wherein said periphery of said convex portion of said pawl tooth has the shape of a portion of a sine wave.

4. A cable tie according to claim 1, wherein said strap and pawl teeth constitute first strap and pawl teeth, respectively,

said cable tie further comprising a second strap tooth which extends from said primary grip surface, said second strap tooth having a transverse cross-section bounded by an outer periphery having a planar portion which is perpendicular to said adjoining portion of said primary grip surface, said outer periphery of said second strap tooth further having a convex portion, said second strap tooth being oriented relative to said strap such that said planar portion of said second strap tooth faces said head,

said cable tie further comprising a second pawl tooth which extends from said grip surface of said pawl such that said second pawl tooth extends into said passageway when said pawl is in said initial locking position, said second pawl tooth being removed from said passageway when said pawl is in said insertion position,

said second pawl tooth having a transverse cross-section bounded by an outer periphery having a planar portion which is perpendicular to said central axis of said passageway when said pawl is in said initial locking position, said outer periphery of said second pawl tooth further having a convex portion, said second pawl tooth being oriented relative to said passageway such that said planar portion of said second pawl tooth faces said exit end when said pawl is in said initial locking position,

said planar portions of said first and second pawl teeth being separated from one another in the direction which is perpendicular to said planar portions thereof by a distance which is equivalent to the distance between said planar portions of said first and second strap teeth in the direction which is perpendicular to said planar portions thereof.

5. A cable tie according to claim 1, and further comprising a plurality of strap teeth each of which extends from said primary grip surface, said strap teeth each having a transverse

cross-section bounded by an outer periphery having a planar portion which is perpendicular to said adjoining portion of said primary grip surface, said outer periphery of said strap teeth each further having a convex portion, said strap teeth each being oriented relative to said strap such that said planar portions of said strap teeth each face said head, said planar portions of adjacent pairs of said strap teeth being separated from one another in the direction which is perpendicular to said planar portions thereof by an equivalent distance.

6. A cable tie according to claim 1, wherein said movement of said pawl between said initial locking position and said insertion position is by pivoting of said pawl about said flexible connection of said pawl to said base.

7. A cable tie according to claim 1, wherein said strap is oriented relative to said head such that, when said strap is inserted into said passageway, the entire portion of said primary grip surface between said base end and said exit end is perpendicular to said central plane.

8. A cable tie for bundling elongate articles, said cable tie comprising:
an elongate strap having opposing free and base ends, said strap further having a longitudinal central axis and being deformable into a loop such that said central axis is contained in a central plane,

said strap having a primary grip surface and a transverse strap tooth which extends therefrom, said strap tooth having a transverse cross-section bounded by an outer periphery having a planar portion which is perpendicular to said adjoining portion of said primary grip

surface, said outer periphery of said strap tooth further having a convex portion, said strap having a secondary grip surface opposite from said primary grip surface; and

a head having a base extending from said base end of said strap such that said planar portion of said strap tooth faces said head, said head having a passageway with opposed entry and exit ends such that said free end of said strap can be inserted into said passageway through said entry end and exit said passageway through said exit end, said passageway having a longitudinal central axis which is contained in said central plane,

said head having a pawl which is flexibly connected to an inner surface of said base such that said pawl is adjacent to said passageway, said pawl being biased to an initial locking position and movable therefrom to a supplemental locking position, said pawl being further biased thereto from said initial locking position,

said pawl having a grip surface and a pawl tooth which extends from said grip surface of said pawl such that said pawl tooth extends into said passageway when said pawl is in said initial and supplemental locking positions, said pawl being removed from said passageway when said pawl is in said insertion position,

said pawl tooth having a transverse cross-section bounded by an outer periphery having a planar portion which is perpendicular to said central axis of said passageway when said pawl is in said initial locking position, said pawl tooth being oriented relative to said passageway such that said planar portion of said pawl tooth faces said exit end when said pawl is in said initial locking position, said grip surface of said pawl having a concave portion between said planar portion of said pawl tooth and said exit end,

said head having a planar support surface which defines a side of said passageway which opposes said pawl such that, when said strap is sufficiently inserted into said passageway

through said entry end, said pawl is biased to said supplemental locking position wherein said concave portion of said grip surface of said pawl forcibly engages said convex portion of said primary grip surface of said strap such that said secondary grip surface of said strap is urged into engagement with said support surface to provide frictional resistance to said retraction of said strap.

9. A cable tie according to claim 8, wherein said concave portion of said pawl has a curvature which corresponds to a curvature of said convex portion of said strap tooth.

10. A cable tie according to claim 8, wherein said secondary grip surface of said strap has a planar portion for said engagement with said support surface when said pawl is biased to said supplemental locking position to forcibly engage said strap.

11. A cable tie according to claim 8, wherein said movement of said pawl from said initial locking position to said supplemental locking position is by pivoting of said pawl about said flexible connection of said pawl to said base.

12. A cable tie for bundling elongate articles, said cable tie comprising:
an elongate strap having opposing free and base ends, said strap further having a longitudinal central axis and being deformable into a loop such that said central axis is contained in a central plane, said strap having a primary grip surface; and
a head having a base extending from said base end of said strap, said head having a passageway with opposed entry and exit ends such that said free end of said strap can be inserted

into said passageway through said entry end and exit said passageway through said exit end, said passageway having a longitudinal central axis which is contained in said central plane,

said head having a pawl which is flexibly connected to an inner surface of said base such that said pawl is adjacent to said passageway, said pawl being biased to an initial locking position and movable therefrom to a supplemental locking position, said pawl being further biased thereto from said initial locking position, said pawl having a heel a portion of which moves into engagement with said base when said pawl is moved from said initial to supplemental locking positions to obstruct said movement of said pawl beyond said supplemental locking position, said pawl having a grip surface which defines a side of said passageway,

said head having a support surface which defines a side of said passageway which opposes said side thereof defined by said grip surface of said pawl such that, when said strap is sufficiently inserted into said passageway through said entry end, said pawl is biased to said initial locking position wherein said grip surface of said pawl forcibly engages said primary grip surface of said strap such that said strap is urged into engagement with said support surface to provide frictional resistance to said retraction of said strap, said retraction of said strap further causing movement of said pawl from said initial locking position to said supplemental locking position to increasingly force said strap against said support surface to increase said frictional resistance wherein said movement of said pawl beyond said supplemental locking position is obstructed by the engagement of said portion of said heel with said base.

13. A cable tie according to claim 12, wherein said movement of said pawl from said initial locking position to said supplemental locking position is by pivoting of said pawl about said flexible connection of said pawl to said base.